

DETAILED ACTION

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on April 29, 2008 has been entered.

The disclosure is objected to because of the following informalities: the equation on page 12, around line 14 is missing. Applicants are reminded that no new matter can be added into the instant specification.

Appropriate correction is required.

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 4-4, 11-14, 16-17 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably

convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

In claim 3-4, 11, 13, 17 Applicants are requested to point out support, in the instant specification by page and line number, for the limitation "SO₂F₂ produced by said decomposition of PFC" and "said toxic component containing at least one of SO₃ and HF produced by said decomposition of said PFC". It should be noted that the SO₂F₂ is disclosed in the instant specification as a "hazardous component", not a product of the "decomposition of PFC" (note page 12, lines 7-8 and the decomposition products listed on page 4, lines 11-13 that do not include SO₂F₂); if the "toxic component" as required in the instant claims is the same as the disclosed "hazardous component", there would be no support for such "toxic component" to contain "at least one of SO₃ and HF produced by said decomposition of said PFC".

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 3-4, 11-14, 16 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claims 3-4, 11, 13, in the second step, "a toxic component" is required to be decomposed, however, in the fourth step, it is required that "said toxic component containing at least one of SO₃ and HF produced by said decomposition of said PFC", it is unclear if the "toxic component" still remains in the fourth step or only the

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decomposition product(s) of the decomposing step of the toxic component is/are present?

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 3-4, 11-14, 16-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over EP 0 885 648 in view of JP 11-216,455, Lang et al (6,235,256), Bowker (4,687,543) and optionally further in view Geisler et al (4,465,655).

EP '648 discloses a process for decomposing fluorine compounds, comprising the steps of contacting a gas flow containing the fluorine compounds, which comprises fluorine as a halogen element, and any of the elements carbon, nitrogen and sulfur as a compound with the fluorine, with a fluorine compound-decomposition catalyst in the presence of steam to hydrolyze the fluorine compound in said gas flow, wherein said gas flow containing said fluorine compounds is contacted with a catalyst comprising Al to convert said fluorine compounds to hydrogen fluoride (note claim 1). In the equation 4 and 5 on page 3 of EP '648, when SF₆ or NF₃ is being decomposed, SO₃ or NO is formed. In the embodiments 6 and 7, SF₆ or NF₃ is diluted with air or nitrogen, the resulting gas is contacted with a catalyst to decompose the fluorine compound. The decomposed gas is scrubbed in an alkaline scrubber (note page 10, lines 1-25).

EP '648 discloses that sulfur oxides such as SO_2 , SO_3 and the like, and nitrogen oxides, such as NO , NO_2 , and the like, are generated in some cases. In order to neutralize and eliminate these products, a method of scrubbing the decomposed gas by spraying an aqueous alkaline solution is desirable (note paragraph bridging pages 3-4). Thus, the scrubbing step is considered as the step of removing SO_x and NO_x from the washed gas.

The difference is EP '648 does not disclose (1) the step of decomposing a toxic component containing SO_2Cl_2 and (2) the step of removing SO_x or NO_x from the decomposed gas after scrubbing by passing the gas after the scrubbing step through a cyclone or demister.

For (1), the halogen compounds to be decomposed in EP '648, such as CF_4 , C_2F_6 , etc. are compounds that are used as a semiconductor etching agent. EP '648 does not disclose the presence of a toxic component containing SO_2Cl_2 .

Bowker '543 discloses a method for selectively etching an insulating layer overlying a body of material including silicon comprising the steps of: subjecting said layer to a plasma discharge in a gas mixture containing sulfur hexafluoride as a non-carbon containing source of volatile fluorine ions, and a fluorocarbon (note claim 1 and column 2, lines 42-48). Bowker '543 further discloses that while from the broad standpoint any non-carbon containing source of volatile fluorine or chlorine ions can be used in the plasma, only certain fluorides are useful as a practical matter in view of corrosion and toxicity problems, etc. Other fluorides which can be a source in such a plasma of volatile fluorine atoms are nitrogen fluoride, boron fluoride, sulfuryl fluoride

(note column 3, lines 4-14). Thus, Bowker '543 fairly suggests in the semiconductor industry, it is advantageous to use an etchant that comprises a non-carbon containing source of volatile fluorine ions, such as sulfuryl fluoride, and a fluorocarbon and the exhaust gas resulting from the process of using such etchant would contain both fluorine containing compound.

For the second "decomposing" step, EP '648 discloses that the stream to be treated can contain more than one fluorine compound and the catalyst can contains at least one element selected from the group consisting of Zn, Ni, Ti, Fe, Sn, Pt, Co, Zr, Ce, and Si in addition to Al (note page 3, lines 8-15). Thus, when more than 1 element was used in addition to Al, the first element with Al is considered as the claimed "decomposition catalyst" and the second element with Al is considered as the claimed "toxic component decomposition catalyst".

Optionally, Geisler '655 can be applied to teach a process for the removal of sulfuryl fluoride from exhaust gases by reacting sulfuryl fluoride in the exhaust gases with a dilute aqueous alkali metal hydroxide or alkali metal carbonate solution on an active carbon catalyst (note claim 1).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use an etchant containing sulfuryl fluoride in addition to the fluorocarbon disclosed in EP '648, as suggested by Bowker '543 because the presence of sulfuryl fluoride proves desired selectively in plasma etching without undesired polymer coating of the plasma chamber. It would also have been obvious to one skilled in the art to further remove the sulfuryl fluoride from the exhaust gas by adding an

additional catalyst member to the catalyst disclosed in EP '648 or by the process suggested by Geisler '655 because sulfuryl fluoride is a toxic compound that needed to be removed before the exhaust gas can be released into the atmosphere.

For the order to removing the fluorine-containing compounds, i.e. sulfuryl fluoride and fluorocarbon compounds, it would have been obvious to one skilled in the art to carry out the steps of removing the fluorine-containing compounds in any order as long as they are effectively removed. Ex parte Rubin , 128 USPQ 440 (Bd. App. 1959) (Prior art reference disclosing a process of making a laminated sheet wherein a base sheet is first coated with a metallic film and thereafter impregnated with a thermosetting material was held to render prima facie obvious claims directed to a process of making a laminated sheet by reversing the order of the prior art process steps.). See also In re Burhans, 154 F.2d 690, 69 USPQ 330 (CCPA 1946) (selection of any order of performing process steps is prima facie obvious in the absence of new or unexpected results); In re Gibson, 39 F.2d 975, 5 USPQ 230 (CCPA 1930) (Selection of any order of mixing ingredients is prima facie obvious.).

For (2) JP '455 discloses a process for treating an exhaust gas generated in a process of making printed circuit board by passing the exhaust gas through a catalytic thermal decomposition device 4 and the waste gas cleaning device 5 and discharged as a harmless exhaust gas 6 (note English abstract). As shown in Figure 3, the exhaust gas after scrubber 5 is introduced into a cyclone 8. Here the moisture within the exhaust gas is removed and recycled back to the scrubber 5 thereby minimizes the

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requirement of fresh scrubbing liquid. JP '455 further teaches that a demister can be used instead of a cyclone (note paragraph 0036).

For the limitation of “ the removed mist is then drained through a liquid waste outlet... in the emission said of said gas exhausted in said exhausting step”, since JP '455 desires to recycle the moisture back to be used as scrubbing liquid, it would have been obvious to one skilled in the art to recover such moisture in the form of a liquid and it would also have been obvious to one skilled in the art to repeat the moisture removing step and to select proper equipment to effectively recover and recycle as much as possible of the moisture in the exhaust gas. It would have been obvious to one skilled in the art to provide a storage tank or a buffer tank to store the recovered moisture in order to accumulate enough moisture for the recycling step or to compensate for the fluctuation in the amount of moisture recovered.

For the instant claim 16, it would have been obvious to one of skill in the art to optimize the inlet velocity to effectively remove the moisture from the exhaust gas and to select an appropriate material for the construction of the cyclone to withstand the condition of the process.

It would have been obvious to one of ordinary skill in the art at the time of the invention was made to pass the exhaust gas after the scrubbing step in EP '648 to a cyclone or demister, as suggested by JP '455, because by doing so, the moisture can be removed from the gas and recycled to the scrubber thereby minimizes the requirement of fresh scrubbing liquid. Such step would inherently remove any remaining NO_x or SO_x from the washed gas.

Lang '256 is further applied to disclose a process for scrubbing acid gases, in which, the improvement is a demister arranged at a location after the liquid droplets have been sprayed by the spray means into the flow path of the flue gases (note column 3, lines 8-43 and claim 1). The demister can be a two-level demister, i.e. two demisters (note column 2, lines 36-38 and claim 1).

It would have been obvious to one of ordinary skill in the art at the time of the invention was made to pass the exhaust gas of EP '648 to a demister, as suggested by Lang '256 in order to obtain the advantages as disclosed in Lang '256 (note, for example, column 1, lines 44-50).

Claims 3-4, 11-14, 16-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kanno et al (PGPub US 2001/0001652) in view either JP 11-216,455, Lang et al (6,235,256), Bowker '543 and optionally further in view of Geisler '655.

Kanno '652 is an US counterpart of EP '648.

Kanno '652 discloses a process as mentioned for EP '648 (note claim 1, Examples 11-12).

The difference are Kanno '652 does not disclose (1) the step of decomposing of a toxic component and (2) the step of removing NO_x or SO_x after the scrubbing steps.

For (1), Bowker '543 and optionally Geisler '655 is/are applied as stated above.

For (2), JP '455 and Lang are applied to teach the step of passing the gas after the scrubbing step to a cyclone or demister.

Applicant's arguments filed April 29, 2008 have been fully considered but they are not persuasive.

Applicants argue that none of the applied references disclose the step of draining each of the liquid discharged from the lower liquid waste outlet and the liquid discharged from the upper liquid outlet through separate piping connections extending from the lower liquid waste outlet and the upper liquid waste outlet, respectively, to a storage tank.

In the above rejection, JP '455 fairly teaches the use of a cyclone to recover the moisture in the exhaust gas after the decomposition step. It would have been obvious to one skilled in the art to recover the moisture from the cyclone as disclosed in the any known manner. The use of the two separate piping connections are considered as "apparatus" limitations, and given little weight unless such use provide unexpected results for the process of decomposition of PFCs. For the storage tank, since the amount of recovered moisture would fluctuated, it is expedient to one skilled in the art to provide a holding tank so that the recovered moisture can be stored before it is being reused in a controlled manner.

Applicants argue that JP '455 does not disclose any storage tank.

JP '455 fairly teaches that the mists or moisture removed by the cyclone, i.e., a mist separating apparatus, can be recycled back to the scrubber and it would have been well within the skill of the artisan to provide a storage tank to serve as a buffer tank in order to regulate the amount and/or rate of the recovered moisture back to the scrubber.

Applicants argue that Applicants are not concerned with recycling mist or moisture removed by a cyclone back to a scrubber.

It should be noted that the motivation for modifying the prior art can be different than the reason provided in Applicants' claimed invention.

Applicants argue that Applicants have found a new problem that the washing with water or alkaline aqueous solution causes a part of HF, SO₃, NO in the decomposition product to form a mist accompanied with water and such mist clears the washing tower.

In response to applicant's argument that by removing the mist, the emission of a part of HF, SO₃, NO in the decomposition product, the fact that applicant has recognized another advantage which would flow naturally from following the suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious. See *Ex parte Obiaya*, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985).

Applicants argue that because the separated mist contains a corrosive component in a concentrated form, the waste water is discharged as the waste water 20 without being returned to the gas washing tower 13.

It should be noted in both EP '648 and JP '455, the scrubbing liquid is an alkaline solution, any remaining acid gases such as HF, SO₃, NO in the mist after being removed from the mist would be neutralize by the alkaline scrubbing liquid.

Applicants argue that EP '648 does not disclose the step of removing of HF, SO₃, and NO before exhausting into the atmosphere.

As stated above, JP '455 is applied to suggest a reason to remove the mist and thereby inherently removing the HF, SO₃, NO in the mist.

Applicants argue that Lang '256 does not the decomposition of NF₃, SF₆ and other limitations as required in Applicants' claims and there is no description about the removal of HF, SO₃, and NO before exhausting into the atmosphere.

Lang is only applied to teach that two demisters can be used to effectively remove mists from exhaust gases and thereby inherently removing the HF, SO₃, and NO from the mist.

Applicants argue that JP '455 does not disclose the decomposition of NF₃, SF₆, the washing of the gas.

JP '455 is not relied upon to teach these features. JP '455 is applied to teach the desire to use a demister, i.e. cyclone, to recover the moisture in the exhaust gas. In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

The rejection over Kanno '652 is maintained for the same reasons as stated above.

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ngoc-Yen M. Nguyen whose telephone number is (571) 272-1356. The examiner can normally be reached on Part time schedule.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stanley Silverman can be reached on (571) 272-1358. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Ngoc-Yen M. Nguyen/
Primary Examiner, Art Unit 1793

nmn
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